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ABSTRACT

Research is reviewed on the validity of the Kindergarten Screening Inventory (KSI), an instrument developed by the Houston, Texas Independent School District to screen kindergarten students for possible difficulties that could lead to learning problems. The KSI includes eye-hand coordination, language learning, gross-motor subtests, as well as vision and hearing items. It is concluded that there is some evidence to support the content, criterion-related, and construct validity of the KSI. (RD)

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Validity Studies of the Kindergarten Screening Inventory*

by

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Abstract

This paper reviews the validity studies to this date on the Kindergarten Screening Inventory (KSI). It is concluded that there is some evidence to support the contention that the KSI has content, criterion-related and construct validity.

Validity Studies of the Kindergarten Screening Inventory

Validity has generally been defined as the accuracy with which an instrument measures the construct or constructs it was designed to measure (e.g., Magnusson, 1966) and more recently in terms of the inferences or predictions that can be made on the basis of performance on the instrument. That is, what construct does the test measure, and can these construct measurements be used to predict some other category of performance (Standards for Educational and Psychological Tests, 1974). In addition, the logic of convergent and discriminant validity (Campbell and Fiske, 1959), is generally applied to the predicted relationships among constructs. That is, one would expect certain measures of constructs to be related or correlated and other constructs not to be related.

Validity refers to serveral related concepts and can be assessed in several ways (Anastasi, 1968). In brief, any theoretical relationship expected among constructs which receives empirical support is evidence of the validity of an instrument.

The Houston Independent School District has developed an instrument to screen all kindergarten students in the school district for possible difficulties that could lead to learning problems. The Kindergarten Screening Inventory (KSI) has Eye-Hand Coordination, Language Learning, and Gross-Motor subtests, as well as vision and hearing items. Alston and Doughtie (1975) have shown that the KSI measures the same constructs for males and females and for Anglo

American, Negro American and Mexican American ethnic groups. This paper is a review of the validity studies conducted on the KSI (Houston Independent School District, 1974, 1975).

Content Validity

Content validity refers to the representativeness of the test items to the construct of interest. Content validity is built into a test by defining the construct of interest and then developing test items to measure the construct. Such a procedure was followed in the development of items for the KSI subtests.

One source of evidence for the content validity of a test is the degree to which items designed to measure a construct are intercorrelated. Factor analyses of items on different versions of the KSI have repeatedly resulted in highly interpretable results (Veselka and Duer, Note 1; Wakefield, Note 2; Doughtie & Alston, 1975, 1976). That is, all the items within a subtest load high on one factor and have low loadings on all other factors. Principal component factor analysis followed by varimax rotation (see Harman, 1967) of the 28 items of the 1975-76 KSI resulted in highly interpretable results (Doughtie & Alston, 1976). As can be seen in Table 1, the items from each subtest load high on the same factor and no other factor to define an Eye-Hand Coordination factor, a Language Learning factor, a Gross-Motor factor and a Vision factor. Another measure of the intercorrelation of the items in a subtest is the alpha coefficient (Cronbach, 1970). The Alpha Coefficients for the Eye-Hand Coordination (EHC), Language Learning (LL) and Gross-Motor (GM) subtests for the 1974-75 and 1975-76 editions of the KSI were as follows: EHC=.812, .842; LL=.763,

.802; and GM=.640, .600 (Doughtie & Alston, 1975, 1976). The alpha coefficients and the factor analytic results indicate that the items within each subtest are measuring the same construct.

Insert Table 1 about here

Criterion-Related Validity

Criterion-related validity refers to the ability to predict performance on some criterion from performance on some instrument. Criterion measures obtained at approximately the same time as the administration of the KSI are available on samples of students who were administered the 1974-75 and 1975-76 versions of the KSI.

Professional ratings of vision, eye-hand coordination, language-learning and gross-motor skills were obtained for samples of students who were administered the 1974-75 version of the KSI. The professional ratings on vision were done by the nursing staff. The ratings of language learning were done by the speech staff, and the ratings of the gross-motor performance were done by members of the physical education department. The validity coefficients between the professional ratings and performance on the KSI subtests designed to measure a similar contruct were as follows: EHC=.60, LL=.34, GM=.31, and Vision - .50 to .57. Kindergarten teachers also rated their students, who had been administered the 1974-75 edition of the KSI, on fine motor skill, language, and gross-motor skill. The validity coefficients between the teacher rating of fine motor skill and the EHC, LL and GM subtests of the KSI were .49, .43 and

.39, respectively. The validity coefficient between the teacher rating of language and the LL subtest of the KSI was .24, and the validity coefficient between the teacher rating of gross-motor skill and the GM subtest of the KSI was .32. The validity coefficients between the professional and teacher ratings and the KSI subtest scores were based on samples of approximately 90 to 105 students, and all of these coefficients were significant at the .05 level or higher. Although these coefficients are small to moderate in size, they do indicate some relationship between performance on the KSI and ratings of performance by kindergarten teachers and members of the nursing, speech and physical education staff.

Additional data on the criterion-related validity of the KSI is available on samples of students who were administered the 1975-76 edition of the KSI. One group of kindergarten students was enrolled in a Title I program (HEART) for students from low income families and another group was enrolled in a special program (KPLC) for students in the bottom third of their kindergarten class.

The students enrolled in the Title I HEART program were administered the Cooperative Preschool Inventory (CPI) (Caldwell, 1970) and the Test of Basic Experiences (TOBE) (Moss, 1970) language section. The CPI is a measure of readiness for school and the TOBE score is a measure of language comprehension. In addition, these kindergarten students had been administered the 1975-76 edition of the KSI, and their enrollment in the HEART program was based on either inadequate performance on a KSI subtest on their teacher's recommendation. The relationships between the KSI subtests and the TOBE and CPI scores were

investigated by regression analyses.

Scores on the three major subtests (EHC, LL, GM) of the KSI were used to predict the CPI and TOBE scores for a sample of 160 students. There was no significant relationship between the KSI variables and the CPI. There was a significant overall relationship between the KSI variables and the TOBE language scores. The multiple correlation was .46 ($F=13.7$; $df=3, 156$; $p < .01$). this means that constructs measured by the KSI can account for approximately 21 percent of the variance in the TOBE language scores. The simple validity coefficients were as follows: EHC and TOBE ($r=.26$), LL and TOBE ($r=.41$), and GM and TOBE ($r=.13$). The first two of these correlation coefficients are significant at the .01 level. This means that there is a significant relationship between both the EHC and LL subtests of the KSI and the TOBE language scores.

Students enrolled in the Kindergarten Precision Learning Center (KPLC) program were administered a criterion-referenced test (CRT) with math and language subtests, and the Wide Range Achievement Test (WRAT) (Jastak & Jastak, 1965) with reading, spelling and math subtests. The KPLC program is designed to build skills necessary for the first grade among children who have been identified by their kindergarten teachers as being in the bottom third of their kindergarten class. The relationships between the KSI subtests and the CRT and WRAT contructs were investigated by regression analyses.

Scores on the EHC, LL and GM subtests of the KSI were used to predict the CRT and WRAT subtest scores for a sample of 41 students. As can be seen in

Table 2 there was a significant overall relationship between the KSI subtests and each of the CRT scores and between the KSI subtests and the WRAT mathematics scores. The KSI subtests scores were not significantly related to the WRAT spelling and reading socres.

Insert Table 2 about here

As can be noted by examining the simple correlation coefficients in Table 3, the significant overall relationships involved the EHC and LL subtests of the KSI. The GM subtest was not significantly related to any of the CRT or WRAT constructs. The moderate, positive validity coefficients between the KSI and the CRT and WRAT scores indicate that a student's performance on one instrument is related to his performance on the other instruments and is an indication that the KSI is an appropriate instrument for screening children for the KPLC program.

Insert Table 3 about here

A more comprehensive and representative set of data was collected during the 1975-76 to 1976-77 school years. All first grade students enrolled in twelve schools, selected to be representative of HISD elementary schools, were administered the Metropolitan School Readiness Test (MSRT) at the begnning of the first grade and the Iowa Test of Basic Skills (ITBS) at the end of the first grade. The scores on the three major subtests of the KSI for the first grade students who had been enrolled in HISD in kindergarten were obtained and matched with the MSRT and ITBS scores. Eight hundred and three students had taken both the KSI and the MSRT and 755 had taken both the KSI and ITBS.

The multiple correlation between the three KSI subtests and each subtest of the MSRT and ITBS were computed using regression analysis. Given the lack of a perfect criterion, intervening remedial services, etc., one would not expect a perfect prediction of later success in school. One would expect a moderate and positive relationship between performance on the KSI in kindergarten and academic performance in the first grade. As can be seen in Table 4, there were moderate positive relationships between the KSI and the MSRT/ITBS subtests (except for the GM subtest). This is evidence that the KSI does measure constructs related to academic performance in the first grade.

Insert Table 4 about here

Construct Validity

The most inclusive category of validation is construct validity. It may be considered to include both content validity and criterion-related validity. According to Cronbach and Meehl (1955), a construct is a hypothetical entity and is defined in terms of its relationship to other such postulated entities or constructs. Construct validation refers to any procedure which results in empirical evidence for the theoretical relationships expected among the constructs. For example, it is expected that items designed to measure the same construct would be highly correlated.

The alpha coefficients for the KSI subtests were moderate to high and the factor analysis of the KSI items resulted in items from the same subtest

loading high on the same factor and having low loadings on other factors.

Conclusion

This paper has reviewed validity studies of the KSI. It was stated that content validity is built into a test by the procedures used to define constructs and produce test items, and that the homogeneity of subtests was evidence for the content validity of a test. The procedures used to define and produce the KSI and the evidence of the homogeneity of the KSI subtests support the contention that the KSI has some content validity. It was stated that criterion-related validity referred to the ability to predict performance on an appropriate criterion from performance on an instrument. All of the criterion measures used in these validity studies were reasonable but fallible, and thus low to moderate relationships with the KSI performance was expected. In short, there is some evidence for the criterion-related validity of the KSI. And it was stated that construct validity refers to empirical support for theoretical relationships expected among constructs. The results of the studies of the KSI cited here support the contention that the KSI has some construct validity.

Reference Notes

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2. Wakefield, J. A., Jr. Final report: Kindergarten Screening Inventory--1973. May, 1974.

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Table I

Principle Components Factor Solution

With Varimax Rotation

N = 1790

KSI Items	F A C T O R S				
	I	II	III	IV	
	Eye - Hand Coordination	Language Learning	Gross Motor	Vision	h2
Vision 1	-.109	-.088	-.053	.886	807
Vision 2	-.119	-.102	-.015	.884	806
Hearing	-.065	-.070	-.059	.216	059
EHC 1	.724	.121	.135	-.067	562
EHC 2	.625	.191	-.005	-.088	435
EHC 3	.739	.117	.098	-.080	576
EHC 4	.610	.071	.178	-.053	412
EHC 5	.505	.202	.046	-.035	299
EHC 6	.768	.197	.051	-.067	636
EHC 7	.753	.234	.063	-.062	630
Adequate	-.822	-.160	-.102	.117	725
LL 1	.205	.565	-.006	-.078	367
LL 2	.106	.697	.060	-.104	511
LL 3	.290	.594	.156	-.119	475
LL 4	.070	.524	.098	-.106	300

Table I
(Cont'd)

LL 5	.128	.467	.058	-.019	222
LL 6	-.002	.461	.057	-.084	223
LL 7	.057	.606	.021	.045	373
LL 8	.311	.701	.045	-.035	591
LL 9	.278	.513	.073	.008	346
Adequate	-.169	-.799	-.121	.074	687
GM 1	.075	-.017	.637	-.077	418
GM 2	.046	-.010	.616	.002	382
GM 3	.097	.185	.584	-.021	385
GM 4	.082	.114	.639	-.083	435
GM 5	.028	-.001	.363	-.022	133
GM 6	.069	.143	.516	-.007	292
Adequate	-.106	-.115	-.851	.031	750
Eigenvalues	6.75	2.39	2.19	1.52	12.85
Percent of Total Variance	15.6	14.1	10.0	6.2	45.9

Table 2

Regression of KSI Subtests on CRT and WRAT

Subtest Scores for KPLC Students

Comparison	Multiple Correlation	F	Significance Level
KSI and CRT Total	.68	10.34	$p < .01$
KSI and CRT Math	.54	4.96	$p < .01$
KSI and CRT Language	.68	10.83	$p < .01$
KSI and WRAT Reading	.35	1.69	NS
KSI and WRAT Math	.58	6.16	$p < .01$
KSI and WRAT Spelling	.40	2.34	NS

Table 3

Correlation Coefficients Between the KSI Subtests and the CRT and WRAT Subtests for KPLC Students

KSI Subtests	CRT			WRAT		
	Total	Math	Language	Reading	Math	Spelling
EHC	.55**	.49**	.52**	.31	.44**	.36*
LL	.59**	.43**	.62**	.24	.50**	.04
GM	.21	.17	.20	.20	-.03	.14

Note: A single asterisk denotes the .05 level of significance, and a double asterisk the .01 level of singificance.

Table 4

Prediction of MSRT/ITBS by KSI Subtests

	Correlation with KSI Subtests			Multiple Correlation
MSRT	EHC	LL	GM	N=803
Auditory Area	.476	.741	.080	.556**
Visual Area	.548	.382	.107	.566**
Language Area	.385	.490	.132	.519**
Quantitative Area	.581	.512	.120	.642**
Reading Skills Composite	.568	.524	.118	.639**
ITBS				N=75S
Vocabulary	.466	.445	.060	.536**
Word Analysis	.471	.482	.096	.557**
Reading Comprehension	.460	.473	.067	.548**
Spelling	.406	.429	.047	.494**
Math Concepts	.465	.464	.070	.545**
Math Problems	.441	.439	.089	.514**
Math Average	.475	.464	.081	.550**
Composite	.515	.522	.086	.609**

**$p < .01$